

Panama to Valparaiso, by Mr. James Douglas, and an account of a visit to the "Wonderful Rivers of Cambodia," by Mr. Frank Vincent.

DR. CREVAUX, the explorer of French Guiana, is not yet, it seems, coming home, but will attempt to reach the Andes by the Iça or Putumayo, exploring that water-system as he has already done the Marori, Ozapok, Yary, and Para.

OUR ASTRONOMICAL COLUMN

BIELA'S COMET.—Even if the earth should encounter an unusual number of meteors on arriving at the descending-node of Biela's comet next month, as some have anticipated, the display is likely to be masked to a considerable extent by overpowering moonlight. The earth will reach the node (so far as we can judge of its actual position) on November 27, and the moon will be full on the following day. Remembering that the meteors of 1872 were not generally remarkable for brightness, though there were some notable exceptions, should there be a return of the shower, a large proportion may escape notice. No doubt, however, a strict watch will be maintained during the last week in November. We are not able to judge how near we may be to the meteoric mass which the earth met on November 27, 1872; it would arrive at perihelion at the end of December in that year, but we do not know the exact period in which it was revolving.

It is worthy of note that the effect of the differences of mean anomalies and mean motions when the two nuclei of the comet were last observed in 1852, would in 1879 occasion a difference in the times of perihelion passage to the extent of nearly $3\frac{1}{2}$ days, and the mutual distance of the nuclei would be increased to 0.075 of the earth's mean distance from the sun, or nearly 7,000,000 miles.

Between the year 1772, when the comet was first observed, and 1852, when the last observations were obtained, the node had retrograded upwards of 11° , the perturbation being chiefly caused by the planet Jupiter in 1794, 1831, and 1842.

When we consider the conditions under which Biela's comet appeared in 1805, we are struck with the favourable opportunity which the repetition of such a case may afford for a precise determination of the solar parallax. On the evening of December 8 in that year the comet at transit at Greenwich was distant from the earth less than 0.038, and its horizontal parallax was upwards of *four minutes*; at this time, with a declination of near 24° south, it was rapidly descending below the horizon in Europe, still it was well observable, and of course would have been in a very good position for observation at the Cape of Good Hope. Its appearance also was favourable for accurate observations, which is more than can be said of all comets that have approached near to the earth. Olbers mentions that on this evening when he was observing with Bessel, the nucleus was very small and defined like a planet, and Gauss at the same time compares it to a star of the third or fourth magnitude. There has been no such opportunity since the Cape Observatory was established.

THE GALLERIES OF THE CUTTING ANTS OF TEXAS

MR. MCCOOK, the devoted student of insects, has in preparation a memoir, which will be looked for with the intensest interest, resulting from his prolonged investigations into the life-history of the cutting or "parasol" ants of Texas (*Atta fervens*), bidding fair to rival his work upon the agricultural ants.

First, let us take with Mr. McCook a brief view of a denuded surface on a high grassy prairie, covered with a number of small moundlets of fresh earth-pellets, yet

without a sign of life, and looking entirely abandoned; over its surface were seen little heaps of dry twigs and pieces of leaves. But towards evening, hosts of ants hurried out, and formed two long double columns to the top of an overhanging live-oak. The ants in the descending columns all carried above their heads portions of green leaves, whence they derive their popular name of "parasol" ants. The closing of the gates in the morning came to pass thus:—Bits of dry twigs and leaves of various lengths are carried into the gallery, filling it up from half an inch to an inch and a half below the surface; often the galleries slant inwards, even to 45° ; or divide soon. The larger "castes" carry in the refuse; as the hole closes the smaller castes appear. The "minims," in small squads, fill in all interstices with minute grains of sand, and finally the last steals in behind some bit of leaf, and the establishment is closed. The reverse takes place, when outside work is resumed in the evening. When the larger forms get out they at first carry away and drop their burdens, and little seems to be accomplished for a long time. But in a marvellous way there occurs a final rush, by which the gate is opened. The bigger pieces of twigs are evidently regarded as special treasures, and were seen used on several successive days. The use of the smallest castes is thus found; some remain at only one-sixteenth of an inch long, while the fertile female attains nearly an inch, and the male is three-fourths of an inch long. The interior of the formicary is composed of caverns or pockets communicating with the surface and with each other by tubular galleries. The chambers contained masses of very delicate leaf-paper wrought into rude combs. Some masses were hemispheres in shape, others were arranged in columns two and a half inches high, in contact, along the floor of the chambers, whose dimensions might be nearly three feet by one foot, and eight inches high. Some hung from tree-roots which passed through the chamber. All this material was composed of the fibre of leaves reduced to this form within the nest. In each portion of ant-comb the cells were nearly hexagonal, but very varied in size, some being half an inch in diameter, but most of them as minute as one-eighth of an inch. Large circular openings ran into the heart of the mass. Ants of the small castes were very numerous in these cells. The material of the comb was very fragile and perishable. It is supposed by Mr. McCook that the ants feed upon the juices of the leaves, but this waits further confirmation. Some of these chambers are even of very large dimensions; one of the size of a flour-barrel was seen, being the main cavity of a formicary, in which were found very many winged males and females and larvæ. This was situated 669 feet from a tree that stood in the front yard of a house, which these ants had stripped. Mr. McCook took a plan of the underground way traversed by the ants to reach this point; the course varied very little from a straight line; two branches had been made to a peach orchard 120 feet distant. Only the small forms appear to take part in the digging, while the larger assist in opening the gates, make the excursions, and do the leaf cutting. The least forms, or minims, assist in opening and closing doors, and taking charge of larvæ. The minims are quite ferocious in attack, and gallantly support the large-headed soldiers. The process of leaf-cutting has been so successfully observed by Mr. McCook, that it is quite deserving of further notice, which we hope soon to give.

G. T. BETTANY

ROUTES TO CHINA *via* ASAM

THE possibility of connecting India with China by a tolerably direct and easy trade route overland is a question of increasing interest to us all, in India and England. Not only would such a route benefit the large valley of Asam, by causing an influx of labour more or

less useful for the growth and manufacture of tea, and convert it from a *cul-de-sac* into a great highway. But the spectacle would be removed of two large and populous empires touching each other, and in harmony, yet having no direct intercourse.

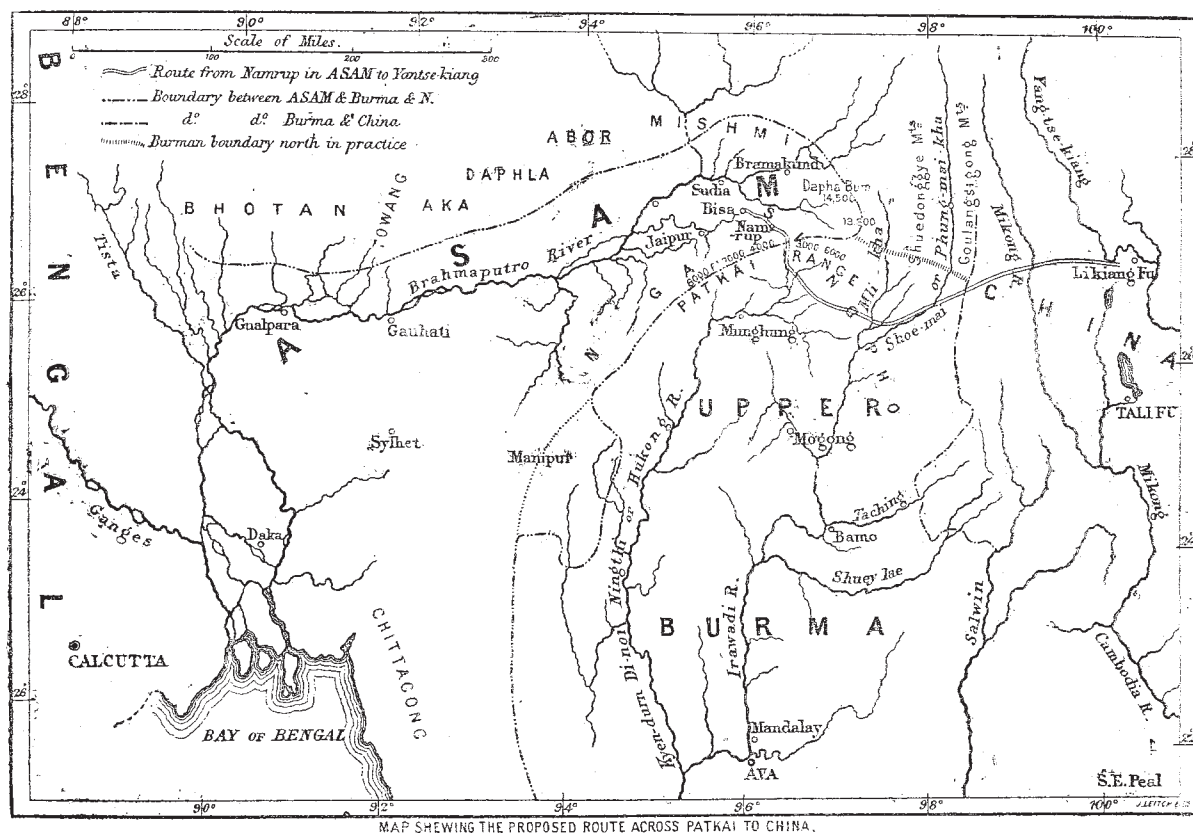
In past times this subject received careful attention from those who were in a position to judge of the relative values of the various routes, and whether *viâ* Kamaun, Nipal, Sikim, Bhutan, or the Mishmi Hills the elevations were found to range from 10,000 to 18,000 feet, often at several points on each line, and there has been an almost unanimous agreement that the route from Asam *viâ* Patkai and Hukong Valley presents the least difficulty.

Pemberton, in his report on the north-eastern frontier in 1835, after a survey of Manipûr, Passage through the Naga Hills and knowledge of the Bhutan frontier, unhesitatingly reports it as the best route "presenting no serious obstacles."

The late General Francis Jenkins (Governor-General's agent in Asam from 1834 to 1868) was well acquainted with the various routes, and says:—"By this pass is—to the best of my information—the only practicable line throughout the encircling mountain ranges from Asam and India into Burmese territory, and thence to China."

Lieut. Charlton also, who had experience on this question, says (*Journal A.S.B.*, 1835):—"What a pity there is no means of communication between Sadia and Yunan, a good land road, and there are no natural obstacles of any consequence to prevent it, would afford an outlet for British merchandise into the very heart of China."

In 1868 and also in 1869 Mr. H. L. Jenkins crossed Patkai near the site of the old route, and demonstrated that the only obstacles of any note were of a political, and not a physical nature (*Proceedings, A. S. Bengal*, July, 1870, p. 230). In January last, 1879, the Chief Commissioner of Asam kindly permitted me to cross the Patkai and ascer-



tain relative and actual elevations, and briefly I may say that the extreme altitude of the track where I crossed the range is 3,445 feet above the sea, and 2,734 feet above the level of the Asam valley, the descent on the Burma side being about 1,000 or 1,200 feet only, the passage from the river levels of one side to the other being always done in one day, or one and a half if herds of cattle are taken; but it is noteworthy that the range is much lower at a short distance to the east, where it is easily seen that passes exist at 2,000 feet or less, where the old track is reputed to have been, by which the Ahoms and the Burmese army entered. The whole range is covered by a dense tree jungle, and any one acquainted with the sturdy hillmen who use this track will understand that the present route is selected simply because it presents an easy passage. The trouble of climbing a few hundred feet more or less is of little consequence to these hardy mountaineers. It

is also near some villages where provisions are procurable, the country east being absolutely uninhabited.

After crossing Patkai I descended to the Nongyang Lake, a sheet of water about 1,800 by 1,000 yards, lying in an open flat grassy valley, about 10 miles long by 2 or 3 broad. As I had taken a *Rob Roy* canoe with me, I was able to get out on the lake and had a good view of the range; the lake and valley level stands from 1,500 to 2,000 feet above that of Asam. On returning, my party crossed from the Nongyang Lake on the Burmese side to the river Nunki on the Asam side, in about seven hours of actual travel.

Hitherto the great obstacle to any route this way was thought to be difficulty of crossing Patkai; it was considered an impassable barrier, even by those in favour of a joint route from Asam and Upper Burma. But it is now clear that this barrier does not exist, and that an

easy and low route is possible. Thus the first step in a good and easy trade route out of India is secured, and secured here alone.

From Nongyang the usual route for traders is *via* Namyung, Songphú village in a level plain of same name, thence *via* the Turong villages and rolling slopes of the upper part of the Danoi valley and the low Kako hills dividing it from the Irawadi. On crossing this latter two routes are available, one up the Shoemai Kha and Sittang flat country, the other more east, turning the southern extremity of the Goulang si gong range, that coming down from the north divides Burma from China. Such a route would also pass round the heads of the Taeping, Shueyif, and Salwin valleys, and leave but one large stream, the Mikong, to cross ere reaching the Yangtse Kiang, at a point near Li Kiang fu, navigable at all seasons—the main artery of China. The total distance of such a route from the plains of Asam at the Namphuk to the Yangtse I estimate at 300 miles to 350, including windings, and to clear out a serviceable bridge path or fair weather road on this I estimate would cost but 10,000*l*. The present path for long distances is a mere jungle track often obstructed by fallen trees; small deep gullies necessitate long *détours*. Were some of the jungle removed and fallen trees, a few strong logs felled over the little streams would make a good commencement.

I need not say much regarding the advantages of such a route, if available. For political reasons it was once thought desirable to discourage direct intercourse between India and China; but that day has departed. England is now one of the three great Asiatic powers, and the time has arrived when we must not only examine our passes west and east, but cultivate as far as possible a profitable and peaceful intercourse with China. The state of Upper Burma (once a Chinese province) simply renders this question urgent. At a time also when Australia and America are invaded by such hordes of cheap labourers, labour paying heavily for its own transport to distant and overstocked markets, we see Asam—close to the labour source—suffering from a want of it, and planters paying Rs. 80 and Rs. 100 per head ere they can employ labour of a very inferior stamp.

S. E. PEAL

KARL FRIEDRICH MOHR

BY the death of Dr. Mohr, of Bonn, which is just announced, the science of chemistry has lost a worker whose labours have extended over nearly half a century, and have led to great and valuable results.

Dr. Karl Friedrich Mohr was born at Coblenz in November, 1806. His earliest work was devoted to the continuation of the Pharmacopœia, established by Geiger. The work by which he will be best remembered is the "*Lehrbuch der chemisch-analytische Titrimethode*," which appeared in 1855 and 1856, the second, and considerably enlarged edition, appearing in 1862. His published papers, which are very numerous, arrange themselves in two classes mainly, those devoted to meteorology and those having a bearing on volumetric analysis. Ground-ice, the earliest information about ozone, St. Elmo's fire are among the subjects of his earliest, and among his later the lower ends of lightning conductors, hail and rain, and confirmation of his theory of the formation of hail. The other more numerous class of papers on analysis extend over nearly fifty years. His examination of the method of separating copper and silver appeared in Liebig's *Annalen der Chemie* in 1832, to be followed by others on the condensation of chlorine, on Marsh's method, preparation of barium hydrate, the reduction of silver chloride, the action of the air on arsenides, and thirty years later on the value of indirect analysis, on nitrate determinations, the estimation of the different oxides of manganese, analysis without the use of weights, examination of a method of determining the

specific gravity of liquids with a watch, phosphoric acid determinations, &c.

About ten years ago he published his "*Allgemeine Theorie der Bewegung und Kraft*," and shortly afterwards "*Mechanische Theorie der chemischen Affinität*."

About four years ago he sent to Liebig's *Annalen der Chemie* a curious paper on the nature and mode of origin of meteorites. He finds that all the silicates present in meteorites contain a little water, and when heated strongly or fused have a decreased specific gravity; that some meteorites contain organic compounds like certain terrestrial carbon compounds, but that meteoric iron contains no combined carbon.

THE INTERNATIONAL ASTRONOMICAL SOCIETY

THE eighth Annual Meeting of this Association was held at Berlin on September 5 to 8. The sixth and seventh meetings of the Society were held at Leyden (1875) and at Stockholm (1877). At the latter place Berlin was selected for the next general meeting, to be held in the present year. This city being more centrally situated for the greater part of the members than Leyden or Stockholm, it was expected that a rather large proportion of the Fellows of the Society would meet there; and so it has proved. There were present the following sixty-one astronomers, mechanicians, and opticians:—Abbe (Jena), Auwers (Berlin), Baeker (Nauen), de Ball (Gotha), H. G. van de Sande Bakhuyzen (Leyden), Bamberg (Berlin), Bansa (Frankfort), Becker (Berlin), Behrmann (Elsfleth), Bergmann (Berlin), Boguslawski (Berlin), Bruhns (Leipzig), Bruns (Berlin), Denker (Hamburg), Drechsler (Dresden), Elkin (New Orleans), Engelmann (Leipzig), Förster (Berlin), Franz (Königsberg), Friesach (Graz), Fuess (Berlin), Galle (Breslau), Gylðen (Stockholm), Hasselberg (Pulkowa), Huggins (London), Kempf (Potsdam), v. Knorre (Berlin), Kreutz (Bonn), Krüger (Gotha), Küstner (Strassburg), Lehmann (Berlin), Lehman-Filhès (Berlin), Lohse (Potsdam), Maywald (Berlin), Merz (Munich), Möller (Lund), Müller (Potsdam), Neumeyer (Hamburg), Oppenheim (Berlin), Oudemans (Utrecht), Palisa (Pola), Pechüle (Copenhagen), v. Plaenckner (Gotha), Pihl (Christiania), Reichel (Berlin), O. Repsold (Hamburg), Romberg (Pulkowa), Rosén (Stockholm), Rümker (Hamburg), Safarik (Prag), Schönfeld (Bonn), Spörer (Potsdam), Tiede (Berlin), Tiele (Copenhagen), Tietjen (Berlin), Valentiner (Mannheim), Vogel (Potsdam), Wanschaffe (Berlin), Winkler (Leipzig), Winnecke (Strassburg), Wittstein (Leipzig). Hence, besides forty-six Germans, there were present three Fellows from Austria, three from Sweden, two from Holland, two from Denmark, two from Russia, and one each from America, England, and Norway.

The Council, composed of Prof. Krüger, President, Prof. Förster, Prof. Gylðen, Prof. van de Sande Bakhuyzen, Vice-presidents; Prof. Bruhns, Librarian, Director Auerbach, Treasurer; Secretaries, Professors Schönfeld and Winnecke, met on September 1, to consider the matters to be submitted to the meeting.

The day before the opening of the general meeting there was unveiled at the Berlin Observatory, in the presence of Encke's son and daughter, surrounded by many distinguished guests, the bust of the distinguished astronomer, who founded the new observatory at Berlin, and rendered it famous by incessant labour. The bust was made by the celebrated artist, Afinger. Prof. Förster, to whose exertions this acknowledgment of his predecessor is due, recalled to the assembled guests in spirited words the great astronomer's principal merits.

On September 5 the general meeting was opened at ten o'clock in the morning by Prof. Krüger, in the lecture hall of the Royal Academy of Sciences. The Minister for Public Instruction, Herr von Puttkammer, welcomed